PUBLIC SERVICE COMMISSION OF WEST VIRGINIA

General Investigation to determine whether
West Virginia should adopt a plan for open
access to the electric power supply market
and for the development of a deregulation plan.
Case No. 98-0452-E-GI

Rebuttal Testimony of
Bruce E. Biewald

On Behalf of
The Consumer Advocate Division

Synapse Energy Economics, Inc.

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1. INTRODUCTION AND QUALIFICATIONS

Q. What is your name, position and business address?

A. My name is Bruce Edward Biewald. My address is Synapse Energy Economics, Inc., 22 Crescent Street, Cambridge, Massachusetts, 01238.

Q. Please describe your current employment.

A. I am President of Synapse Energy Economics, Inc., a consulting company specializing in economic and policy analysis of electricity restructuring, particularly issues of consumer protection, market power, stranded costs, efficiency, renewable energy, environmental quality, and nuclear power.

Q. What are your qualifications in the fields of electric utility regulation and energy policy?

A. I graduated from the Massachusetts Institute of Technology in 1981, where I studied energy use in buildings. I was employed for 15 years at the Tellus Institute, where I was Manager of the Electricity Program, responsible for studies on a broad range of electric system regulatory and policy issues. I have testified on energy issues in more than fifty regulatory proceedings in twenty states, two Canadian provinces, and before the Federal Energy Regulatory Commission. I have co-authored more than one hundred reports, including studies for the Electric Power Research Institute, the U.S. Department of Energy, the U.S. Environmental Protection Agency, the Office of Technology Assessment, the New England Governors' Conference, the New England Conference of Public Utility Commissioners, and the National Association of Regulatory Utility Commissioners. My papers have been published in the *Electricity Journal*, *Energy Journal*, *Energy Policy*, *Public Utilities Fortnightly* and numerous conference proceedings, and I have made presentations on the economic and environmental dimensions of energy throughout the U.S. and internationally. My resume is provided here as Exhibit BEB-1.

Q. What are your qualifications specifically with regard to market power, market prices, and electric industry restructuring?

A. I have analyzed electricity market power and market price issues in New York, New England, and PJM. I have testified in the New Hampshire restructuring docket on behalf of the Consumer Advocate, and in the Vermont restructuring docket on behalf of the Department of Public Service; in Consolidated Edison's restructuring case on behalf of the City of New York; in nine Pennsylvania restructuring dockets on behalf of a coalition of intervenors; in four Connecticut restructuring dockets on behalf of the Office of Consumer Counsel; and in Mississippi's restructuring docket on behalf of the Attorney General.

I have conducted a simulation analysis of market power in New England on behalf of the New England Conference of Public Utility Commissioners. I was retained by the Maine Department of Attorney General in July of 1997 to work on a study of market power issues raised by the prospect of retail competition in the electric industry. My June 11, 1997 report was filed by NECPUC with its comments to FERC on market power in New England. My testimony on market power in New England was filed on January 23, 1998 in FERC Docket Nos. OA97-237-000 and ER97-1079-000.

I have analyzed the market power implications of the proposed merger of Allegheny Power System with Duquesne Light Company on behalf of the Maryland Office of People's Counsel. This analysis was presented in my testimony before the Maryland Public Service Commission (Case No. 8774) and in my Affidavit filed in the corresponding FERC docket (No. EC97-46-000).

I have analyzed the proposed merger of American Electric Power and Central and South West, preparing testimony for a coalition of intervenors in FERC Docket Nos. EC98-40-00, et al.). I have analyzed the proposed merger between Scottish Power and PacifiCorp on behalf of the Utah Committee of Consumer Services and the Public Counsel Section of the Washington Office of Attorney General.

I have conducted many electric system simulation analyses over the past eighteen years. In the last two years I have applied computer simulation models to electricity markets in New England, New York, PJM, and the Midwest.

I have been invited to speak on market power issues by the National Association of Regulatory Utility Commissioners, the New England Conference of Public Utility Commissioners, the National Consumer Law Center, and the National Association of State Utility Consumer Advocates.

2. SUMMARY AND RECOMMENDATIONS

Q. What is the purpose of your testimony in this case?

A. I was retained by the Consumer Advocate Division to respond to aspects of the AEP and Allegheny Power filings on stranded costs.

Q. Please summarize your testimony with regard to market power and divestiture of generation.

A. Divestiture is a critically important aspect of electric industry restructuring, because it can address market power problems and provide market valuation of the generating assets. I conclude that horizontal market power is a concern in the West Virginia market, based upon the following:

- the experience in the Midwest market in the summers of 1998 and 1999;
- the modeling analysis that I did of market power in the context of the APS-Duquesne merger that showed market power to be a problem even in the absence of the merger;
- the modeling analysis done by Dr. Pifer in support of the proposed merger that – when corrected for an error – showed bidding supplies above marginal cost to be extremely profitable; and
- the modeling analysis done by Dr. Hieronymus in support of the proposed AEP-CSW merger, showing that AEP has a market share of in its own “destination market” of 37 to 53 percent in “economic capacity” and 99.8 percent in “available economic capacity.”

Divestiture can also address the vertical market power problems discussed by Tim Woolf in his testimony for the CAD in this case (and specifically in his report filed as an Exhibit to his Direct Testimony).

Divestiture can also provide an accurate value for generating plants, and simultaneously maximize that value, by selling the plants to the highest bidder.

Q. Please summarize your testimony with regard to Dr. Pifer's modeling of the electricity market in this case.

A. I address Dr. Pifer's analysis of market prices for Allegheny Power in Section 4 of this testimony. While I have not been able to fully review Dr. Pifer's analysis of market prices in detail due to time constraints and confidentiality concerns, I can conclude that his analysis:

- Employs a model that is complex, is subject to claims of confidentiality, and has in a prior case been found to contain a fundamental error (while that particular error is not a concern in this case, the possibility of other unidentified errors is a concern);
- Understates market prices relative to recent actual market experience and current futures market prices;
- Is similar to a prior analysis by Dr. Pifer using the same model and methodology that was flatly rejected for stranded cost valuation by regulators in a neighboring state.

Q. Please summarize your testimony with regard to Dr. Pifer's statistical analysis of comparable sales.

A. Dr. Pifer conducts a statistical analysis of comparable sales prices in order to inform the valuation of Allegheny Power generating assets. Dr. Pifer's analysis suffers from problems with the data, the methodology, and the result. Specifically:

- His data on other sales includes sales in the Western Interconnection, where generators typically have lower value perhaps due to periodic hydro surpluses;

- His data includes two sales that were at book value, not because this was the highest price a buyer was willing to offer, but because the competition in those divestitures was on the lowest price for associated buy-back power;
- His data set has various inconsistencies related to the cost and capacity of the transactions;
- His methodology – "stepwise regression" – is a technique that is not highly regarded by statisticians, producing equations that have biased measures of fit and that can be meaningless or misleading;
- His resulting equations in this case have variables that make little logical sense.

Q. Please summarize your testimony with regard to responsibility for stranded costs and gains.

A. I believe that Mr. Chernick's analysis showing large negative stranded costs for AEP and Allegheny is reasonable. The appropriate rate treatment for such gains is to provide the full value to consumers, since they have been paying for the plants, including a return on the investment, and shareholders have apparently been insulated from risk. For example, AEP's position in this case is that shareholders are entitled to recovery of stranded costs (Dr. Landon's testimony, page 5). If this is the case – and it would seem to be based upon regulatory decisions providing for recovery of stranded costs from customers in high-cost states – then it is unconscionable to take the gains in plant value away from customers of electric utilities in low cost states such as West Virginia, where there are negative stranded costs. If the market value in excess of book value is captured by the utility shareholders, then restructuring will put tremendous upward pressure on electricity prices paid by customers. Deregulation of generation in this way, with a windfall benefit to shareholders, is not in the public interest.

Q. What do you recommend in this case?

A. I recommend that divestiture of generation assets be done as a part of any restructuring process. I recommend that Dr. Pifer's modeling analysis of market prices and statistical analysis of comparable sales both be rejected. I recommend that the restructuring process be designed such that the full value of any negative stranded costs (market value in excess of book value) is assigned to customers.

3. MARKET POWER AND DIVESTITURE OF GENERATION

Introduction

Q. Do you believe that divestiture of generation is an important aspect of electric industry restructuring?

A. Yes. Divestiture is a critically important aspect of electric industry restructuring, because it can simultaneously address the potential for horizontal and vertical market power problems and provide market valuation of the generating assets. A well run auction of generating assets could obtain the best price for those assets, thereby minimizing stranded costs or maximizing the restructuring gain.

Q. What is AEP's position on divestiture?

A. AEP's witness Dr. John Landon takes a position against divestiture. He testifies that "...it is an exceedingly crude and draconian instrument for achieving a fairly limited objective. Requiring divestiture to determine value is like killing a fly with explosives" (page 33).

Q. What is APS's position on divestiture?

A. According to the Direct Testimony of Mr. Michael Morrell, Allegheny Power "does not, at this time, contemplate selling generating assets" (page 5).

Q. What is your view on the Companies' positions on divestiture?

A. Dr. Landon and Mr. Morrell fail to appreciate the full range of important reasons in favor of divestiture. It not only provides the best measure of value for stranded cost determination – it can also solve the horizontal and vertical market power problems in the most straightforward and satisfying manner. Divestiture of generation is a large step that is not to be taken lightly, but restructuring the electric industry is itself a grand and ambitious endeavor.

Horizontal Market Power

Q. Is market power a problem in West Virginia electricity markets?

A. As long as electricity prices are set according to the traditional regulatory process, market power is not a problem. However, as the industry is restructured and electricity generation, in particular, is deregulated, market power becomes a major concern.

Q. Please comment on the connection between horizontal market power and market prices.

A. Market power in electricity markets will be a crucial factor in determining the level of market prices. As the experiences in the summers of 1998 and 1999 indicate, suppliers in the wholesale market will be able to bid very high prices in some significant number of hours of the year. That is, suppliers of generation are unlikely to behave in the manner that is assumed in the market models that are used by Allegheny Power to estimate market prices in this case. Instead, it is quite likely that suppliers will find it profitable to withhold capacity from the market in some situations and/or to bid above marginal costs. Such, opportunities to profitably and legally exploit market power will serve to raise market prices and decrease any stranded costs (or increase the magnitude of negative stranded costs).

It is my belief that a strong, independent ISO should have broad authority and resources to monitor and correct market power abuse. However, there is no ISO or any type of RTO operating in the Midwest today, and it appears that development of a strong, independent ISO will proceed slowly in the Midwest region. Even if a strong, independent ISO is established, it is also certain that some opportunities to exploit market power will arise and be realized, driving up market prices. It is my belief, based upon analyses that I have done in other cases, that market power is likely to have a very significant influence upon electricity market prices. Any projection of market prices that does not incorporate the upward effect of market power upon market price is conservative (i.e., likely to be low).

Q. Are you aware of any regulatory commissions that have incorporated market power as a factor in determining future market prices?

A. Yes. In its recent orders in the stranded cost dockets for Connecticut Light & Power Company and the United Illuminating Company, the Connecticut Department of Public Utility Control considered testimony on future market prices submitted by several parties and testimony that I prepared on market power and its influence on market prices. The Connecticut DPUC decisions in those cases used a projection of electricity market prices from a marginal cost based model, but adjusted the model's energy market price results upward by ten percent in order to reflect "the functioning of an imperfect market in the real world" (page 23, Decision in Docket No. 99-02-05 and page 19, Draft Decision in Docket No. 99-03-04).

Q. Is it possible to use computer models of the electricity market to analyze whether and to what extent market power is likely to be present in a particular market?

A. Yes. Computer models can be very helpful in understanding the extent to which profit-maximizing companies will find it possible and attractive to exert market power. The models can also be helpful in analyzing the extent to which various monitoring and mitigation procedures might be helpful in detecting and discouraging undesired behavior by companies with market power. The Company has not conducted any such modeling specifically in this case. Because of time constraints, I have not conducted any such modeling for this case either.

Q. Have you performed any analysis of market power in the APS area previously?

A. Yes. I conducted some analysis of market power in the context of the APS-Duquesne merger case at FERC (Docket No. EC97-46-000) in support of my Affidavit on behalf of the Maryland Office of People's Counsel and in the context of the APS-Duquesne merger case before the Maryland Commission (Public Service Commission of Maryland Case No. 8774). I applied the *Electric Market Optimization Model* (ELMO) model to simulate the APS-Duquesne system, and found that market power can be expected to be a considerable problem without the merger and a much greater problem post-merger.

Q. Has Dr. Pifer performed any analysis of market power in the APS area?

A. Yes. Dr. Pifer conducted an analysis of strategic bidding behavior using the GE-MAPS model in his testimony in support of the APS-Duquesne merger, in FERC Docket No. EC97-46 et al.

Q. What did Dr. Pifer's analysis of market power show?

A. While Dr. Pifer claimed that his results indicated that "bidding up" was not profitable, in fact, he had made a crucial mistake in his modeling. When corrected, the result was quite the opposite. That is, Dr. Pifer's GE-MAPS results showed that bidding above competitive levels would be quite profitable, and that bidding up by 15 percent is even more profitable than bidding up by 10 percent. Dr. Pifer's modeling error, and its implications for market power in the APS area are discussed on pages 5 through 11 of my February 9, 1998, testimony in Maryland Case No. 8774 (provided here as Exhibit BEB-2).

Q. Has AEP performed any analysis of market power?

A. Dr. William Hieronymus prepared an analysis of market power in support of the proposed merger of AEP and CSW. His testimony was filed in FERC Docket Nos. EC98-40-000, et al. This analysis focused upon the measures of concentration -- market share and the Herfindahl-Hirschman Index (HHI) -- rather than strategic bidding and effects of market power upon market price.

Q. What did Dr. Hieronymus' analysis of market concentration show?

A. Dr. Hieronymus' analysis on behalf of AEP and CSW shows very concentrated supply in the AEP market. Specifically, the base case result (in his Exhibit No. AC-512) shows, not surprisingly, that the AEP destination market is dominated by AEP supply. In terms of "economic capacity," AEP's market share ranges from 37 percent to 53 percent, depending upon the time period. In terms of "available economic capacity" AEP's market share is as high as 99.8 percent, yielding an HHI of 9970. The HHI is a commonly-used measure of market concentration, defined as the sum of the squares of the market shares of individual firms. The FERC's merger policy and the Department of Justice and Federal Trade Commission guidelines for evaluating mergers indicate that at an HHI above 1800 shows that the market is "highly concentrated" and adverse effects of market power are "presumed."[1]

Q. What is your conclusion with regard to horizontal market power in the Midwest?

A. Based upon the analyses of market power I have conducted in other cases, and based upon the analyses of AEP and APS consultants in other cases, I conclude that horizontal market power deriving from concentration of ownership of generation could be a tremendous problem. The generation portion of the electric industry in West Virginia and the surrounding region should not be deregulated without changes to decrease the concentration in the ownership of generation.

Vertical Market Power

Q. Does divestiture of generation also address vertical market power concerns?

A. Yes. In the absence of divestiture, the vertically integrated utilities would own and control the transmission and distribution system that forms the backbone and the bottleneck for the generation market in which they would compete. This type of vertical integration of bottleneck monopoly facilities with competitive businesses can be expected to produce anti-competitive behavior. Tim Woolf's testimony on behalf the Consumer Advocate Division in this case, and in particular his report provided as Exhibit TW-2 with his direct testimony, address the problem of vertical market power and the inadequacy of even a strong code of conduct to address this.

Divestiture as Valuation Technique

Q. Is divestiture helpful beyond its role in addressing horizontal and vertical market power?

A. Yes, divestiture offers the additional benefit of determining a market value for a utility's generation assets. Divestiture can eliminate the uncertainty associated with an administrative determination of stranded costs, and therefore can help

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1 FERC Merger Policy Statement, CCH Statute and Regulations, paragraph 31,044, at 30119.

resolve one of the more contentious issues arising from electricity industry restructuring. Also, because with divestiture the sale is to highest bidder, divestiture can serve to "mitigate" any stranded costs (or maximize gains).

The magnitude of stranded costs may be estimated by an administrative procedure or determined by a market test. With an administrative procedure, the costs of utility assets are compared to projected market prices. Complex models of the power system are used to simulate the operation of generating facilities in future years and to forecast market prices. Administrative estimation of stranded costs is daunting, since future inputs such as fuel prices are unknown and many important details of the market structure are yet to be determined.

With a market test, the generation assets are offered for sale. The potential buyers will then decide how much to bid for the resources, based on their perception of the market value. The potential buyers will presumably develop their own projections of market prices for electricity and asses their own exposure to market risks.

Q. Is divestiture of generation taking place in other regions of the U.S.?

A. Yes. In those states where retail competition is being introduced to the electricity industry, regulators have recognized the need to divest generation assets in order to mitigate market power problems and to determine market value for stranded cost purposes. Utilities in California, Connecticut, Illinois, Maine, Maryland, Massachusetts, Montana, Nevada, New Jersey, New York, Pennsylvania, Rhode Island have divested, or are in the process of divesting, their generation assets, and more utilities are expected to follow suit. Mr. Chernick's Exhibits in this case lists several dozen individual sales of generating capacity into the market.

4. ELECTRIC SYSTEM MARKET PRICE MODELING

Q. What is involved in simulating an electric power system?

A. Computer modeling of electric power systems involves simulating the dispatching of generating resources to meet customer loads.

Q. What inputs are required for simulation modeling of an electric power system?

A. Many types of input data are required. All of the generating resources, existing and future, are represented in the model with data specified for capacity, forced and scheduled outage, efficiency ("heat rate"), variable O&M costs, and fuel costs. To the extent that capacity expansion decisions are analyzed, the fixed costs of constructing and operating the future resource options should be included as well. Purchases from non-utility generators and from neighboring regions are included. Air emissions can be included by specifying emission rates for generators and market prices for emission allowance of various pollutant types. Customer loads are typically represented by scaling load shapes for a recent actual year upward to reflect forecast growth in customer demand for electricity.

Q. What are the outputs from electric power simulation modeling?

A. The output reports can take many forms and include varying levels of detail. Summary reports typically include capacity, generation, and costs by categories of generator types. Detailed reports can provide similar information for each generating unit. Special purpose reports such as marginal energy costs by time period can also be produced. Data on marginal costs can serve as estimates of the market prices at the times and places where the marginal costs apply.

Q. What model did the Allegheny Power witnesses employ in this case?

A. In Allegheny Power's direct filing in this case, Dr. Howard Pifer presents simulation model results from the GE-MAPS model.

Q. Were you able to fully review the GE-MAPS model application in this case?

A. No. There was simply not time to review the GE-MAPS model runs in this case. I have reviewed applications of the GE-MAPS model in other recent cases, and have found that it is not possible to perform a thorough review because of confidentiality claims. In cases in Maryland and Connecticut Dr. Pifer's consulting firm, PHB, has been somewhat helpful in providing some information and in allowing me and my staff to visit their offices to inspect the GE-MAPS model inputs. Many of the GE-MAPS model inputs are claimed to be confidential to General Electric, the model vendor. This has made it quite difficult to conduct a thorough review of Dr. Pifer's application of the model. For example, while my staff were allowed to look at the input data at PHB's office, they were not allowed to copy any materials or take notes on the written documents or printouts with numbers. In reviewing an application of a complex model with thousands of inputs, this is a severe limitation. In addition, while my staff were allowed to review the GE-MAPS model documentation, the text of the documentation merely described the complex systems for processing the input files to the model – it did not address the substantive issues regarding the methodology and assumptions used by the model. The types of data typically claimed to be proprietary to GE include the generator forced outage rates, maintenance schedules and rates, unit operating parameters, and representation of the transmission system of thousands of buses.

As I discussed in Section 3 of this Testimony, I have had experience in a prior case with the GE-MAPS model in which Dr. Pifer did, in fact, make a fundamental error in modeling market behavior. I have not found a problem of this nature in his analysis in this case, but I do have concerns that there may be errors in the application of GE-MAPS that we were not able to identify due to timing and confidentiality constraints.

Q. How do Dr. Pifer's projected market prices compare with recent actual market prices in the ECAR region?

A. Dr. Pifer's electricity market price projection for the year 2003 is $23.72/MWh on a time-weighted basis (for APS in 1997 dollars, from his Attachment 8). Actual recent prices in the region have been significantly higher than this, as are current futures market prices. These prices are discussed in the testimony of Mr. Paul Chernick.

Q. What did the Pennsylvania Commission conclude about Dr. Pifer's analysis of market prices?

A. Dr. Pifer presented a similar modeling analysis of market prices using the GE-MAPS model in the West Penn Power restructuring case in Pennsylvania. The Pennsylvania Public Utilities Commission was unimpressed with Dr. Pifer's analysis of market prices. The Pennsylvania Commission found in its Order in that case that "The GEMAPS model used by West Penn witness Pifer also inappropriately assumes bid price will be the incremental cost of changing unit operation rather than the average variable cost" (page 105 of the PUC Order in Docket R-00973981), and that "West Penn witness Pifer's valuation must be rejected as unreasonable" (page 104).

Q. Please summarize your testimony with regard to Dr. Pifer's analysis of market prices.

A. While I have not been able to fully review Dr. Pifer's analysis of market prices in detail due to time constraints and confidentiality concerns, I can conclude that his analysis:

- Employs a model that is complex, is subject to claims of confidentiality, and has in a prior case been found to contain a fundamental error (while that particular error is not a concern in this case, the possibility of other unidentified errors is a concern);
- Understates market prices relative to recent actual market experience and current futures market prices;
- Is similar to a prior analysis by Dr. Pifer using the same model and methodology that was flatly rejected for stranded cost valuation by regulators in a neighboring state.

5. STATISTICAL ANALYSIS OF COMPARABLE SALES

Q. Please comment on the use of comparable sales as a method for estimating the value of a portfolio of generating assets.

A. Many electric utilities in the U.S. have recently sold or are in the process of selling generating units. These divestitures present an excellent source of information for valuing other power plants.

Mr. Chernick filed an analysis of plant valuation based upon comparable sales in his direct testimony in this case filed on July 6. His analysis, prepared on behalf of the Consumer Advocate Division, found that Appalachian Power's generating assets are worth on average $762/kW, and that Potomac Edison and Monongahela Power generating assets are worth on average $846/kW and $762/kW, respectively.

Dr. Pifer filed an analysis of plant valuation based upon comparable sales that used a technique called "stepwise regression" to develop an equation for plant value. His analysis, prepared on behalf of Allegheny Power and also filed on July 6, found that Potomac Edison and Monongahela Power generating assets have an average value of $241/kW or $288/kW, depending upon whether one prefers his logarithmic or linear models (page 28). Dr. Pifer's values for Potomac Edison and Monongahela Power coal units range from $116/kW to $275/kW (page 29).

Q. Which of the two comparables analyses do you believe to be superior?

A. Mr. Chernick's analysis makes reasonable use of the available information on comparable sales to value West Virginia generators. Dr. Pifer's analysis used inappropriate data and a problematic statistical methodology. Mr. Chernick's analysis is superior.

Q. Have you reviewed the data that Dr. Pifer uses in his comparables analysis?

A. I have not had the opportunity to review the full data set used by Dr. Pifer. However, he did provide some summary information in his July 6, 1999 testimony in this case. Based upon my review of that summary information, I can identify several serious problems in Dr. Pifer's data.

First, he includes sales in the Western Interconnection. Western sales have generally fetched lower prices than comparable sales in the Northeast and Midwest. The lower prices may be due, in some degree, to periodic hydro energy surpluses. These surpluses can price even the best baseload plants out of the market for months at a time.

Second, Dr. Pifer's data set includes the sales of Commonwealth Edison's Kincaid and Stateline Plants. These simply do not represent sales into a competitive environment. Both plants sold for book value and included 15-year power purchase agreements by ComEd. That is, the competition in these sales was for the best price on the power purchase agreements, not on the highest price for the generators. Dr. Pifer points out in a footnote on page 23 of his testimony that the Kincaid and Stateline generators were sold at prices "far below the current average sales price" but neglects to recognize the reason for this (that they were, by design, transferred at book value).

Third, in the Boston Edison sale to Sithe, Dr. Pifer omits the $121 million that Sithe paid to Boston Edison for a 6-month transitional power sales agreement. Although this amount was separated out for the purposes of the agreement, it still constitutes a portion of the market value.

Finally, there is an inconsistent use of capacity values for the plants involved. In the majority of the sales Dr. Pifer uses the summer capabilities of the plants, which is indicative of the plants' value. However, in some situations he utilizes capacity values that are announced in the sales press releases. These values tend to be a nameplate capacity and do not necessarily reflect the real capability of a plant.

Q. Have you reviewed the methodology used by Dr. Pifer in his analysis of comparable sales?

A. Yes, but only in general terms. That is, I have not had the benefit of "hands on" use of his data set and complete information about his procedure. Nonetheless, I can offer some comments on his method.

Dr. Pifer attempts to go beyond “simple average” of comparable sales, by using regression analysis to explain the observed sales prices based upon various independent variables. That is, he uses a statistical software package test to see whether variables such as plant age, type of generation, type of market, and others can “explain” variation in the sales prices. On pages 33 and 34 of his Attachment 2, Dr. Pifer lists 19 potential independent variables that he tested. This is quite a large number of possible explanatory variables, particularly for an analysis with only 41 actual observations to try to “explain.”

Q. Out of all the possible combinations of the explanatory variables how does Dr. Pifer arrive at the set of explanatory variables in his recommended equation?

A. He uses a technique called “stepwise regression.” This is a variation of ordinary least squares (OLS) regression, which involves testing potential explanatory variables one at a time, and then selecting the one that adds the most to the “adjusted r-squared” (a measure of the correlation). Then the remaining potential explanatory variables are tested and one is added. With the variation of stepwise regression employed by Dr. Pifer, at each step the computer checks to determine whether any of the previously selected variables should be removed (because it fails to meet a specified cutoff criteria). In effect, the computer progresses by adding and rejecting variables until an equation with the highest possible adjusted r-squared is arrived at.

Q. What is the benefit of using this technique?

A. Stepwise regression is a useful technique for sifting through many possible combinations of explanatory variables in an automated way, and arriving at what might appear to be a good equation for explaining the dependent variable.

Q. Are the measures of fit meaningful?

A. No. With stepwise regression, because the equation was created by trying many explanatory variables in various combinations rather than by testing a sensible hypothesis, the resulting measures of fit (e.g., the adjusted r-squared) are biased. It is not surprising – or particularly meaningful – to end up with an adjusted r-squared of 62 or 69 percent given that the "stepwise" exploratory approach was used to find the equation.

Q. Are the equations that result from the process of stepwise regression useful?

A. Not necessarily. The resulting equations can be meaningless or misleading. Stepwise regression amounts to a mindless testing of many combinations of possible variables, seeking the highest correlation rather than an equation that makes sense. If enough variables and combinations are tested, some will appear significant purely by chance, due to random statistical variation. For every twenty possible explanatory variables that are tested we can expect one to be correlated at a 95 percent confidence level, even if there is no "real" relationship whatsoever. The resulting equation may show a high degree of correlation between the dependent and explanatory variables in the past, with little or no meaning for how they will relate in the future.

Q. Is stepwise regression an accepted technique for selecting an equation?

A. No. Stepwise regression is not a highly regarded technique. Statisticians warn against the use of stepwise regression. For example, Peter Kennedy's "A Guide to Econometrics," a very complete, advanced textbook on econometrics mentions stepwise regression only once. Dr. Kennedy states flatly that "[a] variant of OLS called *stepwise regression* is to be avoided." (page 52, MIT Press, third edition). Many textbooks on econometrics make no mention of stepwise regression whatsoever.

Q. Is there a better way to select a regression equation?

A. Yes. In general one should try forms and combinations of explanatory variables that make sense given the underlying relationships among the variables. The selection of an equation should be based upon thoughtful analysis of the data and an understanding of the logical connections between the variables.

Q. Do the equations resulting from Dr. Pifer's analysis appear sensible?

A. No. Dr. Pifer does logarithmic and linear analyses, arriving at an equation for each, presented in his Attachment 10. His "transmission assets/access" variable is selected to be included in both of the equations – but no information is provided about which sales were ascribed a value for this variable or what the basis for assigning a value was. For the logarithmic model, plants that operate where there is a capacity market were found to have higher value than plants that do not, a result that makes no particular sense to me, since buyers will purchase capacity and energy whether there is a separate centralized capacity market or not. For the linear model, the "annual load growth" variable was found to explain sales price – with higher regional demand growth leading to lower generation value. This is the reverse of what I would expect. Rapidly growing demand would normally, with all other things equal, lead to a higher value for resources that can supply electricity to serve that demand. The fuel type of the generators, a factor commonly cited as a determinant of generator value, did not find its way into either the linear or the logarithmic equations, except that the linear model found "hydro MW" to be correlated with higher price.

Q. What do you conclude with regard to Dr. Pifer's statistical analysis?

A. I conclude that Dr. Pifer's analysis is based upon faulty data; utilizes a statistical technique that is overly automated; and arrives at a resulting equation that is counterintuitive at best. In contrast, Mr. Chernick 's analysis is based upon reasonable data for recent sales; utilizes a straightforward approach that accounts for the key factors that one would expect to determine value; and arrives at a sensible result.

Q. Have you conducted your own statistical analysis of comparable power plant sales?

A. Yes. I have conducted regression analyses using the power plant sales data presented by Mr. Chernick in his direct testimony in this case filed on July 6. The primary objectives of my analysis were (a) to determine whether regression analysis would confirm the results obtained by Mr. Chernick, and (b) to improve upon the statistical analysis performed by Dr. Pifer.

Q. Please briefly describe your statistical analysis.

A. The results of my statistical analysis are presented in Exhibit BEB-3. The dependent variable in my model is the purchase price of each group of power plants sold, in millions of dollars. The explanatory variables in my model are the different categories of plant types within each group of power plants sold. These plant types are the same as those used by Mr. Chernick in his analysis. Thus, my model includes explanatory variables to represent the following plant types: (a) large, new coal units; (b) medium-sized, medium-aged coal units; (c) small, old coal units; (d) oil and gas units; (e) combustion turbine units; (f) pumped storage hydro facilities; and (g) hydro facilities. No combined cycle units were included in this analysis since the sales data had just one observation with that plant type.

I chose these explanatory variables because one would expect them to explain the variation in prices across the different packages of power plants sold. In other words, it is likely that the difference in price between each sale can be explained primarily by the makeup of different fuel types within each package. Bigger, new coal plants can be expected to sell for more than smaller, older plants; and coal plants can be expected to sell for more than oil/gas plants. Conventional hydro plants can be expected to be especially valuable because of their low operating costs.

Q. Do your regression results support this hypothesis?

A. Yes. The regression equation presented in Exhibit BEB-3 has an adjusted r-squared of 93 percent, which represents a remarkably good fit. In other words, the combination of variables in my equation explains nearly all of the variation in the sales prices. In addition, each variable has a t-statistic well above 2.0, indicating that each variable makes a significant contribution to explaining the sales prices in my model.

Q. Are your regression results consistent with results obtained by Mr. Chernick in his direct testimony in this case?

A. My regression results are generally consistent with those of Mr. Chernick. My results indicate that a large, recent-vintage coal unit would sell for $975/kW with a standard error of $51/kW, while Mr. Chernick estimated that such a coal unit would sell for $950/kW. These results are remarkably close, given the size of the data set that we are working with. Page 2 of Exhibit BEB-3 includes a complete comparison of my results with those of Mr. Chernick. While the results for other variables are not as close as those for large coal plants, they are generally quite consistent with Mr. Chernick's results.

Q. Do your regression results represent an improvement upon the statistical analysis performed by Dr. Pifer?

A. Yes. My regression model has a much better fit than Dr. Pifer's, with an adjusted r-squared of 93 percent, relative to his adjusted r-squareds of 62 percent and 69 percent. More importantly, my regression model is based upon a sound hypothesis for explaining the variation of the dependent variable, while Dr. Pifer's regression model is not, because it was derived from the stepwise regression technique, as described above.

Q. Did you test any regression equations other than the one presented in Exhibit BEB-3.

A. Yes. I ran a total of five regression equations, with slightly different categories of plant types as explanatory variables. For example, I ran one regression where all of the coal units were included as a single explanatory variable instead of three. The equation presented in Exhibit BEB-3 has the best explanatory power and includes what I consider to be the most logical combination of variables. However, I found that all five equations had good fits, with r-squareds above 90 percent in each case. In addition, the coefficients of the explanatory variables do not vary much from one regression to the other -- indicating that my results are quite robust.

Q. Please summarize the conclusions that you draw from your statistical analyses.

A. My regression analysis leads to two important conclusions. First, it confirms the results obtained by Mr. Chernick in his direct testimony, and therefore supports his estimates of net restructuring gains among West Virginia utilities. Second, it provides a more logical and more statistically significant regression analysis than the one presented by Dr. Pifer.

6. RESPONSIBILITY FOR STRANDED COSTS AND GAINS

Q. What are stranded costs and gains?

A. Stranded costs are costs that utilities incurred to provide regulated utility service that are not recoverable in the market. For generating resources, to the extent that the market value of the assets is less than book value, there would be some stranded costs. Not all generating assets are uneconomic and not all utilities have stranded costs. Older fossil-fuel and hydroelectric generators tend to be very valuable. Their capital costs have largely been paid off and their operating costs are low. In estimating stranded costs for a particular utility it is important to subtract the value of ***economical*** resources from stranded costs associated with the ***uneconomical*** resources. In other words, stranded cost estimates should be made on a net, system-wide basis. Moreover, for some utilities with attractive resource portfolios, the net stranded cost may even be negative. That is, the company's assets, on a net basis, could have a market value that is higher than the book value. This additional value can be referred to as a "negative stranded cost" or a "restructuring gain."

Q. Do West Virginia's electric utility companies have positive or negative stranded costs?

A. AEP and Allegheny Power have extremely valuable portfolios of generating plants. Mr. Chernick's analysis based upon comparable sales of generating assets concludes that the market value of the AEP and Allegheny Power generating plant is much larger than the book value.

Q. If the implementation of restructuring is delayed, how would the size of stranded costs change?

A. In general, since market prices are expected to increase gradually over time while the investments in existing generating plants are depreciated, it is reasonable to expect that the restructuring gain (the difference between the two) will increase.

Q. What is the implication of these large negative stranded cost figures?

A. The large magnitude of the negative stranded costs indicates that the restructuring process in West Virginia must provide a mechanism to ensure that this excess value accrues to the benefit of consumers. If shareholders are allowed to capture this added value, then restructuring will only result in increased electricity prices for consumers and will not be in the public interest.

For example, if AP were allowed to transfer its generation assets at book value to an unregulated affiliate, as requested by Mr. Morrell, then the unregulated AP affiliate could charge market prices for its electricity and reap windfall profits as a result of obtaining the assets at below-market prices. This creates two important problems. First, customers would pay higher electricity prices than they would in the absence of restructuring. Second, as a consequence of its affiliate transaction with AP, the affiliate would have an enormous unfair competitive advantage over other potential generation suppliers. This unfair advantage might stifle the competitive electricity market by deterring new entrants, and might thereby result in electricity prices that are above competitive market prices.

Q. What do the Companies say in their filings about how restructuring gains should be treated?

A. Mr. Morrell, testifying for Allegheny Power, states that the Commission does not have legal authority to incorporate a credit in rates based upon the value of the generating plants (page 6) and that to do so would be inequitable to shareholders since "AP has every right to choose to remain in the generating business and retain its assets" (page 7). Mr. Morrell goes on to state that "AP should be given permission to transfer its generating assets at book value to an unregulated affiliate..." (page 21).

Mr. Landon, testifying for AEP, takes the position that "[i]f state-mandated competition may result in new values for utility assets in competitive markets in excess of book values, these premium values belong to the stockholders" (page 5).

Q. Did the Companies discuss their views on the treatment of stranded costs?

A. I was not able to locate a clear statement about how stranded costs (if they were to exist) should be addressed in the filing of Allegheny Power in this case. AEP's filing includes a "conclusion" that "There are compelling reasons to allow utilities to collect potentially stranded costs as part of the movement to replace regulation with competition for West Virginia electric utilities" (Direct Testimony of John Landon, page 5).

Q. Is it appropriate to make ratepayers responsible for paying stranded costs (if stranded costs are positive), but to deny them restructuring gains if stranded costs turn out to be negative?

A. No. It is inconsistent and entirely inappropriate to make ratepayers pay for stranded costs, but to deny them the benefits of restructuring gains. Utilities making this argument are unfairly seeking "the best of both worlds." In asking ratepayers to compensate them for stranded costs, these utilities imply that they should be free of the risk associated with their generation investments. However, in denying ratepayers the benefits of restructuring gains, these utilities imply that they alone are entitled to reap the rewards of their generation investments. Such a request for obtaining the rewards without taking the risk is clearly inconsistent, inequitable and inappropriate -- either in the context of a regulated industry, in the context of a competitive market, or during a transition between the two.

Q. Are there utilities and economists who have taken the position that customers are entitled to the gains in situations where market value is above book value?

A. Yes. One particularly relevant example is Dr. Kenneth Gordon, witness for AEP and Allegheny Power on code-of-conduct issues in this docket. Dr. Gordon's position has been that utilities should be entitled to recover stranded costs in situations where market value is below book value. In testimony on behalf of the Edison Electric Institute in Illinois, Dr. Gordon addressed the opposite situation as well:

> I do agree that when the utility is the seller of a service or an asset to an affiliate, and the market value of the regulated asset is higher than the book value, then the utility should, in fact, receive the market value of the asset. Otherwise, the unregulated affiliate (and thus the utility's shareholders) is receiving a financial reward through a discount on that asset, while that financial reward should more properly accrue to those who bore the risk of the investment. In a regulatory setting based on consistent costing principles, this is simply the flip side of the utility's right to be paid full book value

> (by ratepayers) when the market value of assets is below the book value, the so-called stranded cost problem. (Testimony in Illinois Commerce Commission Docket Nos. 9800013 and 98-0035, March 11, 1998.)

I read this to mean that in a low-cost state such as West Virginia, where the generating assets have considerable value in excess of book, that Dr. Gordon would agree with me that customers are entitled to the restructuring gain.

Q. Please summarize your conclusions with regard to stranded costs and restructuring gains in West Virginia.

A. The utilities in West Virginia will clearly have significant amounts of restructuring gains, as a consequence of their valuable coal units. If utility shareholders are allowed to capture these restructuring gains, then customers will lose the benefit of these generating assets and pay higher electricity prices, and restructuring will not be in the public interest.

Q. Does this conclude your testimony?

A. Yes, it does.

Regression Analysis of Comparable Power Plant Sales
Comparable sales data taken from direct testimony of Mr. Chernick in this case.

Regression Statistics	
Multiple R	0.994181722
R Square	0.988397297
Adjusted R Square	0.928974174
Standard Error	133.7310767
Observations	25

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	27422659.2	3917523	219.0518	2.14979E-15
Residual	18	321912.0158	17884		
Total	25	27744571.22			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A
coal1	0.975	0.051	19.150	0.000	0.868	1.082
coal2	0.788	0.104	7.569	0.000	0.569	1.007
coal3	0.277	0.095	2.907	0.009	0.077	0.477
OilGas	0.263	0.037	7.079	0.000	0.185	0.341
CT	0.306	0.090	3.384	0.003	0.116	0.496
PS	0.614	0.123	5.002	0.000	0.356	0.872
Hydro	0.894	0.176	5.088	0.000	0.525	1.264

Comparison of Regression Results with Results of Mr. Chernick

Plant Type	Chernick Comparables Value ($/kW)	Regression Coefficient ($/kW)	Regression 95% Confidence Range
Coal: big, new	$950	$975	$868 - $1,082
Coal: medium	$600	$788	$569 - $1,007
Coal: small, old	$400	$277	$77 - $477
Oil/Gas Steam	$150 - $400	$263	$185 - $341
Combustion Turbines	$150 - $350	$306	$116 - $496
Hydro: Pumped Storage	$490	$614	$356 - $872
Hydro: Conventional	$1,000	$894	$525 - $1,264

Mr. Chernick's results are taken from Exhibit PLC-7 of his direct testimony in this case.